Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Promoting Investment in the 3550-3700 MHz Band	)	GN Docket 17-258
	)	
	)	

REPLY COMMENTS OF T-MOBILE USA, INC.

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T-Mobile USA, Inc. ("T-Mobile")[1/] submits these reply comments in response to the comments on the Notice of Proposed Rulemaking ("*NPRM*")[2/] in the above-referenced proceeding, in which the Commission proposes to modify the rules governing the 3550-3700 MHz band ("3.5 GHz band") Citizens Broadband Radio Service ("CBRS"). The comments support the Commission's proposals to promote investment and support Fifth Generation ("5G") wireless networks. Retaining the current rules – in particular, those that require Priority Access Licenses ("PALs") to be issued for a limited period of time or geographic area – will severely undermine investment in, and use of, the band and are contrary to the public interest.

I. INTRODUCTION AND SUMMARY

The Commission has a unique opportunity in this proceeding to maximize mid-band spectrum for 5G networks, and to help maintain the U.S.'s leadership position in wireless technologies. By making modest modifications to the existing rules for the 3.5 GHz band, the Commission could strengthen the viability of the spectrum without delaying introduction of

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1/ T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company.

2/ *Promoting Investment in the 3550-3700 MHz Band; Petitions for Rulemaking Regarding the Citizens Broadband Radio Service*, Notice of Proposed Rulemaking and Order Terminating Petitions, 32 FCC Rcd 8071 (2017) ("*NPRM*").

service or undermining the fundamental three-tier structure that the Commission has established. Instead, the Commission's proposals would strengthen one of the three tiers by providing stability and incentives to encourage use of and investment in PALs. This, in turn, will promote overall investment in the band and produce more robust use of both PAL and General Authorized Access ("GAA") tiers. The Commission should therefore quickly adopt rules consistent with its proposals and move forward to auction this spectrum.

In particular, the comments support T-Mobile's position that the Commission should:

- Authorize PALs on a standard, ten-year license term with a renewal expectancy.
- Make all PAL spectrum available for auction and permit bidding on specific channels.
- Impose a 30-megahertz spectrum aggregation limit.
- Allow partitioning and disaggregation.
- Prevent disclosure of Citizens Broadband Radio Service Device ("CBSD") registration information.
- Relax out of band emission ("OOBE") limits.
- License PALs on a Partial Economic Area ("PEA") basis.

II. THE RECORD STRONGLY SUPPORTS THE COMMISSION'S PROPOSALS

A. Longer License Terms with Renewal Expectancy Will Promote Greater Interest and Investment in the Band

The Commission proposes to increase the PAL term from three years to ten years and eliminate the requirement that PALs terminate at the end of the license term.[3/] Commenters agree that longer license terms and a renewal expectancy are necessary for the 3.5 GHz band – extending the PAL term will spur development in the band by making the band more favorable for long-term investment. A longer license term, for example, takes into account the multi-year network deployment process. As Nokia explained, it "generally takes several quarters to standardize a new frequency band, another year to develop infrastructure equipment and certify

3/ *NPRM* ¶ 13.

it, and over a year to deploy a network."[4/] Verizon similarly noted that "longer license terms . . . increase incentives for future investment by creating greater operational stability for licensees."[5/] As AT&T stated, a ten-year license term will "promote investment by reducing the risk of stranding assets, and will allow for the development of a balanced and robust licensing regime for the entire 3.5 GHz ecosystem."[6/]

Commenters also agree that a renewal expectancy for PALs will promote investment in the band. As Comcast correctly points out, "[a]n option to renew would significantly improve the business case for initial investment in PALs by removing the uncertainty created by the need to participate in regular auctions to retain priority access."[7/] The renewal expectancy ensures that licensees are able to see their investment activities through to completion once started.

In contrast, there is no evidence that shorter license terms will create incentives for significant investment at 3.5 GHz, and for good reason – that claim is counter-intuitive, particularly for rural areas and smaller providers. Rural areas take longer to build out.[8/] Providers will need more time – not less – to accomplish that. In fact, the Commission routinely issues waivers to give carriers more time to build in rural and remote areas.[9/] Abbreviating

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4/ Comments of Nokia, GN Docket No. 17-258, at 2-3 (filed Dec. 28, 2017).

5/ Comments of Verizon, GN Docket No. 17-258, at 5 (filed Dec. 28, 20117).

6/ Comments of AT&T, GN Docket No. 17-258, at 3 (filed Dec. 28, 2017); *see also* Comments of the Telecommunications Industry Association, GN Docket No. 17-258, at 2 (filed Dec. 28, 2017) ("[T]he current three-year PAL term with no renewal rights significantly undermines incentives for operators to invest in the band.").

7/ Comments of Comcast Corporation, GN Docket No. 17-258, at 20 (filed Dec. 28, 2017).

8/ *See, e.g.*, Comments of Mobile Future, GN Docket No. 17-258, at 6 (filed Dec. 28, 2017) ("[A] longer license term (with renewal expectancy) will encourage deployment in rural areas by providing more time for investors to recoup their investments from a smaller customer base.").

9/ *See, e.g.*, *Petition Filed by Am. Samoa Telecomms. Auth*., 32 FCC Rcd 6436 (WTB 2017) ("[W]e conclude that a waiver of the construction requirements of section 24.203 is warranted. We find that the challenges faced by [American Samoa Telecommunications Authority] in providing service in this remote area, as well as the meaningful public benefit to be derived from access to advanced wireless services

license terms undermines the Commission's determinations regarding the challenges of building out in rural areas. Shorter license terms will *discourage* investment by smaller rural providers in particular because they will be unsure of their ability to earn a sufficient return on their investment. As CTIA points out, "in rural areas . . . with a more limited customer base, return on investment naturally takes longer."[10/] Even in non-rural areas, longer license terms will favor smaller carriers by allowing them additional time to raise capital, construct networks, and build a customer base. Not surprisingly, numerous smaller and rural entities support lengthening the license term for PALs.[11/]

The benefit of longer license terms is supported by the economic analysis submitted by Daniel Vincent, a professor of economics at the University of Maryland, College Park, and commissioned by Verizon. The analysis demonstrates that shorter license terms will discourage long term investment because (i) "the rigid resale timing implied by short-term licenses prevents incumbent license holders from optimally deciding when to attempt to resell their license[,]" and (ii) "a resale auction effectively fixes the terms of trade on resale in such a way that it can

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rises to the level of 'unique or unusual circumstances' and that given these circumstances, strict application of this rule would be contrary to the public interest.").

10/ Comments of CTIA, GN Docket No. 17-258, at 4 (filed Dec. 28, 2017); *see also* Mobile Future Comments at 6 ("[A] longer license term (with renewal expectancy) will encourage deployment in rural areas by providing more time for investors to recoup their investments from a smaller customer base.").

11/ *See, e.g.*, Comments of Colorado Valley Communications Inc., Nortex Communications Company, Pathway Com-Tel, Inc., GN Docket No. 17-258, at 6 (filed Dec. 28, 2017) (stating that "a minimum term of five (5) years and maximum term of ten (10) years with an expectation of renewal would be sufficient to encourage investment with a potential for a reasonable return on investment"); Comments of Peoples Telephone Cooperative, GN Docket No. 17-258, at 1 (filed Dec. 28, 2017) (expressing a preference for ten-year terms with an expectation of renewal); Comments of Nsighttel Wireless, LLC, GN Docket No. 17-258, at 4 (filed Dec. 28, 2017) (stating that it "agrees with the commenters that suggest more than three years is necessary to recover investment in the spectrum and avoid the possibility of stranded investment" and supporting a renewal expectancy); Comments of National Rural Telecommunications Cooperative and National Rural Electric Cooperative Association, GN Docket No. 17-258, at 3-4 (filed Dec. 28, 2017) ("NRTC and NRECA Comments") (supporting a ten-year term with an expectation of renewal).

prevent an incumbent user from capturing as much of the incremental surplus created by earlier investments in the license as it could in a secondary market where it negotiates the resale price."[12/] In addition, secondary markets are less able to result in the optimal license size when licenses are too small, due to the incentive for potential sellers to delay trade until they are the last traders in the secondary market in order to capture larger incremental gains.[13/]

Contrary to some commenters' assertions,[14/] longer license terms will not lead to spectrum warehousing. Particularly prior to the end of a license term, GAA use will prevent spectrum warehousing.[15/] In addition, reasonable end-of-term performance requirements will ensure that licensees continue to merit the priority access that a PAL affords.

A longer license term coupled with a renewal expectation is also consistent with the Commission's current spectrum management practices,[16/] which have resulted in today's robust wireless ecosystem. And as U.S. Cellular explained, "a ten-year, renewable license term also would be consistent with the Commission's proven approach in . . . the mmW bands, which also will be used for the deployment of 5G networks."[17/] Indeed, the Commission's "proven track-

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12/ Comments of Daniel R. Vincent, prepared for Verizon Communications Vincent Study at 4, GN Docket No. 17-258 (filed Dec. 29, 2017).

13/ *See id.* at 6.

14/ *See, e.g.*, Comments of Baicells Technologies North America, Inc., GN Docket No. 17-258, at 4 (filed Dec. 28, 2017).

15/ *See also* Verizon Comments at 7 (stating that opportunistic GAA use will prevent warehousing); CTIA Comments at 7 ("Opportunistic GAA use effectively eliminates any theoretical foreclosure risks[.]").

16/ *NPRM* ¶ 13.

17/ Comments of United States Cellular Corporation, GN Docket No. 17-258, at 11 (filed Dec. 28, 2017); *see also* Verizon Comments at 4 ("More recently, in its *Spectrum Frontiers* proceeding, the Commission once again adopted a ten-year term for all Upper Microwave Flexible Use Service licenses."); Mobile Future Comments at 6 ("A longer license term is even more appropriate given the significant planning and testing involved in deploying new technology and the siting obstacles that often complicate and delay build-out. These same concerns led the Commission to adopt ten-year (or longer),

record in other bands demonstrat[es] the benefits to investment and deployment facilitated by greater certainty of longer license terms with renewal expectations."[18/]

B. Making All PAL Spectrum Available for Auction and Permitting Bidding on Specific Channels Will Ensure a Successful Auction

Commenters agree that the Commission should adopt its proposal to make available the total number of PALs applied for per license area, and that it should allow PAL licensees to bid on specific channel assignments. In other auctions, the Commission has not limited the number of licenses available,[19/] and there is no reason it should deviate from that practice here. Southern Linc correctly points out that there is "no need to artificially limit the number of PALs that can be assigned."[20/] As CTIA notes, "the policy restricting the Commission's ability to assign a PAL when there is only one applicant in a geographic area does not apply in other auctioned services with longer terms and renewable licenses, and there is no reason to maintain that restriction here."[21/] Moreover, restricting the number of PALs available for assignment is inefficient because it "arbitrarily limits the supply of PALs."[22/] As NCTA explains, the Commission's current practice "means that protected spectrum availability will be driven by who else applies rather than by the quality of service needs of a network operator and its customers."[23/] In

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renewable license terms in other bands that will be essential to 5G deployment, including the 28 GHz, 37 GHz, and 39 GHz bands and the repurposed 600 MHz band.").

18/ Nokia Comments at 2.

19/ *See* NPRM ¶ 42.

20/ Comments of Southern Linc, GN Docket No. 17-258, at 17 (filed Dec. 28, 2017); *see also* AT&T Comments at 9 ("AT&T encourages the Commission to offer all PAL licenses for auction, even in areas where there is only one applicant.").

21/ CTIA Comments at 14.

22/ *Id.*

23/ Comments of NCTA – The Internet & Television Association, GN Docket 17-258, at 14 (filed Dec. 28, 2017); *see also* CTIA Comments at 14-15 ("As noted above, no individual applicant seeking the interference protections afforded by PALs should be disqualified from obtaining those rights simply because fewer than seven PALs are sought in a particular geographic license area.").

addition, under the current rules for subsequent PAL auctions, "a PAL licensee would be at risk of losing one of its licenses unless a third party decided to participate[,]" which would require the Commission to auction an even greater number of licenses.[24/] This approach "breeds uncertainty, hindering investment and innovation and ultimately impeding the deployment of innovative services"[25/] and will strand licensee investment rather than promote it.[26/]

Parties also agree that allowing PAL licensees to hold authorizations for particular spectrum blocks will create a more stable and predictable spectrum landscape, which, as AT&T states, is imperative for "[e]ffective network planning."[27/] The added certainty will, in turn, "ensur[e] additional investment in the band."[28/] The American Petroleum Institute and the Regulatory and Technology Committee of the Energy Telecommunications and Electrical Association also note that specific channel allocations in the band will "aid in system optimization."[29/] Allowing licensees to hold specific PAL blocks will enhance spectrum utilization as it will enable coordination between adjacent license holders in the same license area and between co-channel licensees in adjacent license areas. This coordination of technology structure and deployment will not be feasible with the current dynamic PAL assignment scheme

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24/ AT&T Comments at 10.

25/ *Id.*

26/ *See* United States Cellular Comments at 3-4; *see also* CTIA Comments at 15 ("[U]nder the existing licensing rules, the current bidding procedures could result in a 'musical chairs' scenario where the supply of PALs might decline, term after term, resulting in unfair treatment to PAL stakeholders.").

27/ AT&T Comments at 11.

28/ *Id.*

29/ Joint Comments of the American Petroleum Institute and the Regulatory and Technology Committee of the Energy Telecommunications and Electrical Association, GN Docket No. 17-258, at 4 (filed Dec. 28, 2017).

and could result in interference between systems and potential use of guard-bands to mitigate that interference.

Further, allowing PAL licensees to bid on specific channel assignments will enhance potential agreements between GAA licensees and PAL licensees – improving GAA spectrum use as well. As Ericsson states, "[a] strong foundation for PALs makes it easier to accept the dynamic behavior of GAA assignments, as the PAL can be a stable channel when used in conjunction with carrier aggregation with GAA."[30/] In addition, allowing parties to bid on particular blocks at auctions would be consistent with Commission practice in prior spectrum auctions.[31/]

The few parties that favor licensees receiving unidentified PAL rights asserted that static assignments would result in reduced spectrum availability for those licensees when they are preempted by incumbents.[32/] However, T-Mobile's proposal, under which the Commission would assign through auction the seven PALs in the first 70 megahertz of the 3.5 GHz band spectrum (3550-3620 MHz), retaining the upper 30 megahertz of PAL spectrum as a "swing space," would address this concern and permit SASs to assign that open spectrum to the PAL holder.[33/] Should an incumbent preempt a licensee's use of its assigned channel, the SAS would simply temporarily reassign the licensee to a channel within the 3620-3650 MHz band segment.

30/ Comments of Ericsson, GN Docket No. 17-258, at 8 (filed Dec. 28, 2017).

31/ *See* AT&T Comments at 11-12.

32/ *See, e.g.*, NCTA Comments at 15; Comments of Microsoft Corporation, GN Docket No. 17-258, at 8-9 (filed Dec. 28, 2017); Comments of the Wireless Internet Service Providers Association, GN Docket No. 17-258, at 51-52 (filed Dec. 28, 2017); Comments of Dynamic Spectrum Alliance, GN Docket No. 17-258, at 26 (filed Dec. 28, 2017); Southern Linc Comments at 18.

33/ *See* Comments of T-Mobile USA, Inc., GN Docket 17-258, at 11-12 (filed Dec. 28, 2017). As noted further below, the ability of a SAS to re-assign a PAL holder in the case of preemption will be compromised if the Commission issues PAL licenses for small geographic areas. This limitation will exist regardless of whether PALs are assigned on a static or dynamic basis.

C. Parties Recognize the Need for Spectrum Aggregation Limits

Commenters agree with T-Mobile that the Commission should maintain the spectrum aggregation limit in the 3.5 GHz band, and that the limit should be lowered. Spectrum aggregation limits help prevent market concentration, allowing multiple providers to have access to spectrum.[34/] Additionally, spectrum aggregation limits ensure that licensees use the band efficiently.[35/] This is particularly important in the 3.5 GHz band, as the band has limited spectrum available for licensing and is the only mid-band spectrum currently available for 5G wireless broadband. In contrast, if the Commission eliminates the spectrum aggregation limit altogether in the 3.5 GHz band, a single entity could dominate the market, thwarting competition and limiting the development of 5G technology at mid-band frequencies.[36/] As Microsoft Corporation correctly observed,"[t]he public interest would not be served by allowing one licensee to hold all 70 MHz of PAL spectrum."[37/]

Parties agreed with T-Mobile that the Commission should not only maintain the spectrum aggregation limit but that the limit should be lowered.[38/] A lower spectrum aggregation limit

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34/ *See* Comments of Motorola Solutions, GN Docket No. 17-258, at 8 (filed Dec. 28, 2017) ("[A] total utilized spectrum aggregation limit in the band of 40 MHz (*i.e.*, the current PAL limit) [ ] promote[s] diverse access of the band in all locations."); Comments of ATN International Inc., GN Docket No. 17-258, at 8-9 (filed Dec. 28, 2017) ("Such a limit will ensure that numerous entities have the ability to provide service in each geographic area."); Comcast Comments at 15-16 ("[A]n aggregation limit assures a 'minimum degree of diversity' among 3.5 GHz users, consistent with Section 309(j), and will promote innovations that 'may lead to positive spillovers in the development of other spectrum bands in the future.'").

35/ *See* Comments of GeoLinks, GN Docket No. 17-258, at 3 (filed Dec. 28, 2017).

36/ *See* Southern Linc Comments at 17 ("Maintaining a spectrum aggregation limit is essential to protecting against the consolidation of all PALs spectrum in a given area in the hands of a single licensee and ensuring ongoing opportunities for beneficial competition, and thus the spectrum aggregation limit should not be removed.").

37/ Microsoft Corporation Comments at 8.

38/ *See* Southern Linc Comments at 17-18 (suggesting a 20 megahertz limit); NRTC and NRECA Comments at 7 (suggesting a 30 megahertz limit); American Petroleum Institute and the Energy Telecommunications and Electrical Association Comments at 4 (suggesting a 30 megahertz limit).

will "maximize entry" in the 3.5 GHz band and better support competition.[39/] As T-Mobile and other commenters note, if the spectrum aggregation limit is reduced to at least 30 megahertz, up to three entities can secure spectrum in an individual market.[40/]

D. Permitting Partitioning and Disaggregation Will Promote Greater Use of Spectrum in the Band

There was widespread support for the Commission's proposal to allow licensees to partition and disaggregate PALs in secondary market transactions.[41/] Partitioning and disaggregation helps ensure that spectrum is put to its most efficient use. Many parties highlight that partitioning and disaggregation would enable greater licensee flexibility and broader access to and diversity in the band, especially if the Commission extends the license term and uses PEAs for the license area, as it should.[42/] As AT&T explains, partitioning and disaggregation "would allow secondary market transactions to determine the best possible use for unused

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39/ Southern Linc Comments at 18.

40/ T-Mobile Comments at 12; NRTC and NRECA Comments at 7 ("Lowering the aggregation limit to 30 MHz ensures that at least some PAL spectrum will be available for at least one additional CBRS participant across the U.S."); American Petroleum Institute and the Energy Telecommunications and Electrical Association Comments at 4 ("API and ENTELEC support an aggregation limit per census tract not to exceed 40 MHz (for a hybrid PAL/GAA aggregation) or 30 MHz (for purely PAL licenses). If the Commission truly wishes to promote 5G deployments, it should accomplish this goal through license aggregation limits. . . Permitting higher aggregation limits would further curtail competition and several restrict the number of potential bidders.").

41/ *See NPRM* ¶ 31.

42/ *See, e.g.*, Comments of Federated Wireless, GN Docket No. 17-258, at 4 (filed Dec. 28, 2017) ("Federated Wireless also agrees with the Commission that it is crucial to provide mechanisms to enable PAL use by third parties who require reliable spectrum but may not have the need or resources to obtain a license for a Partial Economic Area or other larger license area."); Comments of Cantor Telecom Services, L.P., GN Docket No. 17-258, at 10 (filed Dec. 28, 2017) ("Dynamic disaggregation and partitioning of licenses in terms of geography, duration or bandwidth enhances liquidity and improves demand and value of the spectrum on the secondary market, thus allowing the market to work freely to secure meaningful use and interference protection rights"); AT&T Comments at 8 ("[P]artitioning and disaggregation will alleviate concerns that licensing on a PEA basis will result in underutilized spectrum."); Nokia Comments at 4 (arguing that partitioning and disaggregation will "support a diversity of deployments").

spectrum."[43/] In addition, "[a]llowing petitioning and disaggregation will . . . foster access to PAL spectrum for targeted, local deployments while ensuring effective and efficient spectrum use."[44/] For example, PAL licensees could trade partial PAL rights to licensees seeking smaller license areas, such as small and rural entities, "for any duration of time."[45/] In fact, as Motorola points out, "regardless of license characteristics," partitioning and disaggregation "promise to improve spectrum utilization in the band."[46/]

E. There Are No Public Interest Benefits – But Many Potential Harms – That Would Result From Making CBSD Registration Information Public

There is widespread agreement that the Commission should prohibit SAS Administrators from publicly disclosing *all* CBSD registration information.[47/] Contrary to some claims, publicly disclosing CBSD registration information does not serve the public interest and a lack of disclosure will not cause demonstrable harm.[48/] Rather, publicly disclosing the CBSD registration information increases the risk of harm to potential licensees. The data that SAS

43/ AT&T Comments at 5.

44/ CTIA Comments at 10.

45/ Nokia Comments at 4.

46/ Motorola Solutions Comments at 7; *see also* Comments of the City of New York, GN Docket No. 17-258, at 4 (filed Dec. 28, 2017) ("Partitioning and disaggregation of PALs in secondary market transactions would increase efficiency and, when paired with policies that encourage robustness in such a market, such as strong performance requirements, will help ensure uniform buildout for all users.").

47/ *See, e.g.*, United States Cellular Comments at 18 ("Although the Commission's proposal 'to prohibit SASs from disclosing publicly CBSD registration information that may compromise the security of critical network deployments or be considered competitively sensitive' would be an improvement over the current rule, USCC believes the better, and simpler, approach would be for the Commission to outright prohibit the public disclosure of CBSD registration information."); Verizon Comments at 16-17 ("Verizon sees no compelling evidence that either the CBRS sharing framework or GAA and PAL deployment plans would require the public disclosure of CBSD registration information. Disclosure of private information in exchange for spectrum access should not be mandatory.").

48/ Comments of Starry, Inc., GN Docket No. 17-258, at 7-8 (filed Dec. 28, 2017); Comments of Google LLC, GN Docket No. 17-258, at 22-23 (filed Dec. 28, 2017).

Administrators will be required to collect includes information such as users' network configurations, uses, and technical parameters.

The current rule "is both harmful and unnecessary"[49/] and "insufficient to safeguard critical network data."[50/] AT&T, CTIA, and NCTA agree that SAS Administrators publicly releasing any of the collected information could lead to severe consequences, such as "data being used for anticompetitive purposes," or worse, "pos[ing] a national security risk."[51/] Ericsson agrees that "disclosing CBSD registration information does not serve any useful purpose."[52/] As United States Cellular explains, "[a]n outright prohibition on the public disclosure of registration information . . . would free both CBR Service providers and SAS Administrators from . . . additional burdens [associated with determining what information should be disclosed to the public], while likely also providing additional security for confidential registration information."[53/]

Not disclosing CBSD registration information will not prejudice GAA spectrum users. Instead of requesting that SAS Administrators disclose CBSD registration information, the Commission can "direct[] SAS Administrators to share such information among themselves to facilitate frequency coordination, and with other prospective users[.]"[54/] In this way, GAA users can work directly with SAS to meet their needs without having information unnecessarily disclosed publicly.

49/ CTIA Comments at 11.

50/ AT&T Comments at 12.

51/ CTIA Comments at 11; AT&T Comments at 12-13; NCTA Comments at 17.

52/ Ericsson Comments at 6.

53/ United States Cellular Comments at 19.

54/ Comcast Comments at 31 (supporting SAS disclosure to other prospective users of the 3.5 GHz band in an aggregated form).

F. Relaxing OOBE Limits Will Facilitate the Higher Power Levels Required to Make the Band Successful

Commenters agree that the Commission should relax the emissions limits that apply to CBSDs and end user devices.[55/] These changes will not delay the deployment of CBSD devices in the band. Rather, relaxing the emissions limits will "permit easier implementation of wider channels in the band[,]"[56/] which is necessary because the "3.5 GHz band will serve a core role in the networks of tomorrow — both 4G LTE Advanced and 5G NR — that use channels greater than 10 MHz wide."[57/] Therefore, the emissions limits, as identified in Qualcomm's proposal, "will greatly improve the utility of the band for both PAL and GAA users alike," and promote innovation and investment in the band.[58/] Moreover, the limits proposed by Qualcomm "will not adversely impact adjacent band users because operations near the band edge would continue to be constrained by the -40 dBm/MHz additional protection requirement for adjacent bands."[59/] The few parties that argue that the Commission should not relax the emissions limits[60/] ignore the above benefits that the relaxed emission limits would generate.

55/ *See* Comments of Qualcomm, GN Docket No. 17-258, at 3 (filed Dec. 28, 2017)("Qualcomm applauds the FCC's recognition that 'relaxation of the current emission limits … would promote innovation and investment in the band and allow operators to make use of wider channels without reducing their transmit power."); ATN International Comments at 9 ("With regard to power limits, ATN agrees with Qualcomm that the emission limits should be relaxed to facilitate wider channels without power reduction.").

56/ Nokia Comments at 6; *see also* CTIA Comments at 13.

57/ Qualcomm Comments at 3-4.

58/ Verizon Comments at 18.

59/ *Id.*

60/ *See, e.g.*, Motorola Solutions Comments at 5; Comments of the National Association of Broadcasters, GN Docket No. 17-258, at 2 (filed Dec. 28, 2017); Comcast Comments at 26-27.

III. THE LIMITED PROPOSED CHANGES ARE IN THE PUBLIC INTEREST

A. The Commission's Proposals Do Not Represent a Significant Departure from its Current Framework for the Band

Despite claims to the contrary,[61/] the Commission's proposals are modest, will be beneficial to diverse members of the ecosystem, and do not represent a significant departure from current rules. The proposals will not impact the GAA rules or otherwise limit potential GAA use of the band.[62/] Some parties oppose the Commission's proposals, noting that the three-tier structure of current rules is well-suited for small entities and utilities, and "accommodate[s] myriad uses and dynamic approaches to allocating scarce spectrum resources.[63/] The three-tiered structure, however, will be retained if the Commission adopts its proposals.[64/] The only meaningful change in the Commission's proposals relates to the rules governing PALs, and those changes are merely intended to drive greater investment to the band and conform licenses to the structure that has fostered a successful wireless industry to date.

B. The Commission's Proposals Will Not Strand Investments in the Band

The Commission should reject claims from Wireless Internet Service Providers ("WISPs") and others that the proposed changes will strand investment.[65/] No investments made

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61/ *See, e.g.*, Comments of Open Technology Institute at New America and Public Knowledge, GN Docket No. 17-258, at 3 (filed Dec. 28, 2017) ("OTI and PK Comments").

62/ AT&T Comments at 2 ("AT&T would note that none of the proposed changes in the *3.5 GHz NPRM* affect the underlying GAA rules and should not inhibit efforts to complete rapidly the process of opening the band for GAA use.").

63/ *See, e.g.*, Joint Comments of Cambium Networks, Ltd., Energy Telecommunications and Electrical Association, Utilities Technology Council, GN Docket No. 17-258, at 3 (filed Dec. 28, 2017); *see also* OTI and PK Comments at 9.

64/ CTIA Comments at 3 ("Notably, these changes will enhance the PAL framework without affecting the three tier framework that forms the foundation of the 3.5 GHz band or the spectrum use of the General Authorized Access ("GAA") tier.").

65/ *See, e.g.*, Southern Linc Comments at 11-12; Wireless Internet Service Providers Association Comments at 25; Comments of Next Century Cities, GN Docket No. 17-258, at 3-5 (filed Dec. 28, 2017); Dynamic Spectrum Alliance Comments at 10.

in reasonable reliance on the current rules will be stranded as a result of the Commission's proposals. *First*, WISPs and other non-federal users of the 3650-3700 MHz portion of the band were previously granted licenses covering non-exclusive use of the spectrum.[66/] Under the current rules, those licenses will only continue to be grandfathered until April 2020 or the end of their license terms, whichever is longer.[67/] After that time, these incumbent users will only be able to continue using the band on a GAA basis, and thus any expectations for that band segment in the future would be for unlicensed use only. Therefore, current users of the 3650-3700 MHz portion of the band will not face stranded investment under the Commission's proposals any more than they would under the current rules, since there are no PALs available at 3650-3700 MHz. That portion of the band – and more – will remain unlicensed, and those licensees can continue to operate in the band as they do today. In fact, according to Qualcomm, spectrum sharing mechanisms being developed by the 3rd Generation Partnership Project ("3GPP") will result in even more effective shared use of the spectrum than exists today – effectively making the unlicensed spectrum even better able to support today's operations.[68/]

Second, to the extent WISPS and others believe that this proceeding was an opportunity to convert their unlicensed operations to licensed use of the 3.5 GHz band, they were never assured an ability to migrate their operations, and any such plans were speculative. There was never a guarantee that they would have won PALs at auction and secured access to licensed spectrum, even if the Commission continued to use smaller license areas. The Commission's

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66/ *See Report and Order* ¶ 394-95.

67/ *See id.* ¶ 400.

68/ *3GPP starts study on 5G NR spectrum sharing*, QUALCOMM (Apr. 26, 2017), https://www.qualcomm.com/news/onq/2017/04/26/3gpp-starts-study-5g-nr-spectrum-sharing.

proposals therefore change nothing regarding their status – the grandfathered licensees will continue to be able participate at auction for PAL licenses, just as they can today.

The only meaningful investments in the band were made by the entities that may act as a SAS or ESC. Those investments, as well as any investments in technology,[69/] will be preserved.

C. It Is the Commission's Obligation to Alter the Regulatory Structure When Doing So Serves the Public Interest, As It Does Here

Since the Commission adopted the current rules in 2015, there has been significant growth in the public's demand for mobile broadband services, and 5G technology has emerged.[70/] The Commission must not ignore these developments. Wireless carriers, including T-Mobile, are poised to deploy 5G networks within the next two years.[71/] The 3.5 GHz band will be an important component of the mid-band spectrum landscape. The band is critical to the deployment of 5G operations and the growth of the mobile wireless industry, in general. Unfortunately, contrary to the assertions by the Dynamic Spectrum Alliance and others,[72/]

69/ *See generally* Comments of the General Electric Company, GN Docket No. 17-258, at 20 (filed Dec. 28, 2017) ("Federated Wireless has been involved in forty trials of its SAS technology[.] . . . Google's Alphabet Access, meanwhile, has also engaged in extensive SAS testing and performed the 'first end-to-end demonstrations of CBRS mobile devices.' Numerous other companies have obtained experimental authorizations from the Commission to test equipment, explore network architectures, evaluate market demand, and assess a mix of innovative uses."); Google Comments at 23-24 ("Significant progress has already been made toward finalizing aggregate interference, SAS, and other standards—based on industry's reliance on the Commission's reputation for stability. The Wireless Innovation Forum ('WInnForum') has already released protocols regarding commercial CBSD operations and SAS-to-SAS communication, and Google and Federated Wireless have tested the interoperability of their SAS implementations using these WInnForum standards.").

70/ *See, e.g.*, *Americans' Wireless Data Usage Continues to Skyrocket,* CTIA (May 2017), https://www.ctia.org/industry-data/ctia-annual-wireless-industry-survey (detailing that data traffic increased by 42.2% from 2015 to 2016); Cisco, Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2016–2021 (March 28, 2017), https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html ("Mobile data traffic has grown 18-fold over the past 5 years.").

71/ Letter from Steve B. Sharkey, Vice President, Government Affairs, T-Mobile, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 17-258, 17-183, 14-177, at 2 (filed Jan. 11, 2018).

72/ *See, e.g.*, Dynamic Spectrum Alliance Comments at 4; Southern Linc Comments at 6-9; Starry, Inc. Comments at 2-3.

current rules are *deterring* – not promoting – investment in the 3.5 GHz band because they fail to establish the type of stable environment that providers of any size need to invest in networks. Adopting the proposed modifications to the rules will help encourage investment and ensure the United States' continued leadership in the development of next generation networks.[73/]

In addition, since the current rules were adopted, international focus has shifted to mid-band spectrum, as other countries have recognized that 3.5 GHz band spectrum is useful for next-generation wireless services. As T-Mobile noted in its comments and detailed in previous filings,[74/] Japan has allocated the 3.5 GHz band for mobile broadband,[75/] and Germany plans to allocate spectrum at 3.5 GHz for 5G operations this year.[76/] Global harmonization in the band will produce a robust equipment market, to the benefit of U.S. consumers of mobile wireless broadband products and services. Therefore, the public interest supports a re-examination of the rules, to ensure that they will best promote the use of the spectrum.

Indeed, the Commission is required to re-examine its rules when they no longer serve the public interest.[77/] The Commission has done just that to open spectrum for new technologies and

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73/ *See* United States Cellular Comments at 1-2 ("The 3.5 GHz band, therefore, presents a crucial opportunity to advance 4G and 5G deployments, especially given that it is the only mid-band spectrum that will be made available for mobile broadband operations in the near future.").

74/ *See* T-Mobile Comments at 2; *see* T-Mobile USA, Inc. Petition for Rulemaking, GN Docket No. 12-354, RM-11789, at 6-7 (filed June 19, 2017); Comments of T-Mobile USA, Inc., GN Docket No. 17-183, at 7-9 (filed Oct. 2, 2017).

75/ Kuniko Ogawa, Director for Land Mobile Communications Division, Ministry of Internal Affairs and Communications, Presentation on Japan's Radio Policy to realize 5G in 2020 (June 28, 2016), http://www.gsma.com/spectrum/wp-content/uploads/2016/08/MIC_Spectrum-for-5G-MIC-Kuniko-OGAWA.pdf.

76/ *See* Monica Alleven, *GSMA backs T-Mobile, CTIA's proposed rule changes for 3.5 GHz*, FIERCEWIRELESS (Aug. 10, 2017, 7:17 AM), https://www.fiercewireless.com/wireless/gsma-backs-t-mobile-ctia-s-proposed-rule-changes-for-3-5-ghz; *see also* Reply Comments of T-Mobile USA, Inc., GN Docket No. 12-354, *et al.*, at 3-5 (filed Aug. 8, 2017) (detailing additional efforts in multiple countries).

77/ *See* 47 U.S.C. § 161(b) (requiring the Commission to "repeal or modify any regulation it determines to be no longer necessary in the public interest.").

services. For example, the Commission redesignated microwave spectrum for Personal Communications Service.[78/] And the Commission repurposed the 600 MHz band for new spectrum uses through the highly successful broadcast incentive auction.[79/] Even though the Commission made a decision about the 3.5 GHz band in 2015, that does not mean that the Commission is required to adhere to that decision today if it is no longer in the public interest.

While T-Mobile supports innovative spectrum management techniques, some of those incorporated in the current rules will not enhance spectrum use. Creative management techniques can help overcome specific, identified challenges, and the Commission has done that here by using SASs and ESCs to manage incumbent use and non-use by licensees. But the remainder of the approaches that the Commission seeks to revisit – short license terms and micro-geographic areas – are not intended to resolve these issues, stifle the band's potential by discouraging investment and growth, and should be modified.[80/]

IV. LARGER LICENSE AREAS WILL NOT DIMINISH ACCESS TO THE 3.5 GHZ SPECTRUM

A. Issuing PALs on a PEA Basis Will Promote Investment and Innovation in the Band.

Licensing on a PEA basis is appropriate for the 3.5 GHz band because it better reflects market needs and market realities. Mobile Future correctly emphasizes that "[i]ncreasing the

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78/ *See Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, Third Report and Order and Memorandum Opinion and Order, ET Docket No. 92-9 (1993); *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, First Report and Order and Third Notice of Proposed Rulemaking, ET Docket No. 92-9 (1992).

79/ *The Broadcast Television Incentive Auction Closes; Reverse Auction And Forward Auction Results Announced; Final Television Band Channel Assignments Announced; Post-Auction Deadlines Announced*, Public Notice, 32 FCC Rcd 2786 (2017).

80/ *See, e.g.*, Daniel R. Vincent Comments at 3-4 (discussing how short license terms discourage long-term investments).

PAL license area from census tracts to PEAs will stimulate additional investment, promote innovation, and encourage efficient use of spectrum resources in the band."[81/] Further, as CTIA details, PEA-sized licenses "strike the appropriate balance of facilitating access to spectrum for both large and small providers," which will attract a variety of licensees and promote investment in the band.[82/] PEA-based licensing would also be "consistent with the license area adopted for other 5G bands[,]"[83/] and therefore, adopting PEA-based licensing in the 3.5 GHz band would "provide a more consistent and rationalized license structure across all potential 5G bands."[84/] Arguments that larger license sizes are inappropriate for or will reduce access to the band are based on faulty assumptions, and should be rejected.

B. The 3.5 GHz Band Is Not Simply a Small Cell Band

The presumption that the 3.5 GHz band will be used to deploy small cell technologies and that therefore small license areas are most appropriate is inaccurate.[85/] As Ericsson notes, the 3.5 GHz band will be capable of supporting a variety of use cases – not just small cell applications – "due to the band's propagation characteristics and the amount of spectrum to be made available."[86/] A key parameter in determining a base station's coverage is its antenna height. One of the reasons macro cells provide larger coverage than small cells is because a

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81/ Mobile Future Comments at 7; *see also* Verizon Comments at 8 ("[L]arger licenses would stimulate investment, promote innovation, and encourage efficient use of spectrum resources.").

82/ CTIA Comments at 9.

83/ Mobile Future Comments at 7; *see also* United States Cellular Comments at 5 ("Authorizing PALs on the basis of PEAs also would be consistent with the licensing framework the Commission adopted for both the low- and high-band spectrum that, along with the 3.5 GHz band, will be used to deploy 5G networks.").

84/ Verizon Comments at 9.

85/ *See* NCTA Comments at 6; Dynamic Spectrum Alliance Comments at 13.

86/ Ericsson Comments at 2; *see also id.* at 1 ("[M]id-band spectrum [is] a crucial piece of the puzzle for meeting exploding demand for bandwidth in existing networks and providing capabilities needed for small cell deployment, wide-area networks, and next-generation services.").

macro cell antenna is generally higher than a small cell antenna, which is generally installed below clutter. The notion that the 3.5 GHz band will feature only small cells assumes that outdoor CBSDs will be installed at low heights and therefore would have a very small coverage area. However, there is no requirement for low-profile siting and CBSDs may be installed higher and result in much larger coverage.

And even if providers employ smaller cells as buildout becomes denser to support increased traffic, it does not follow that the license areas should be smaller. In fact, providers are already deploying small cell technology in larger license areas.[87/] It is business cases, not technology, that should dictate the size of a license area – and service is more economically viable with larger service areas and more customers from which to draw. Notably, and consistent with an approach that focuses on business cases, the Commission found that larger license areas – PEAs[88/] – were appropriate in the millimeter wave bands in the *Spectrum Frontiers* proceeding, where propagation is expected to be even more limited.[89/]

C. Larger License Areas Will Permit Intense and Flexible Use of the Band by Providers of All Sizes

Contrary to some commenters' assertions, PEA-sized license areas will not foreclose use of the 3.5 GHz band by smaller providers.[90/] Rather, larger license areas would maximize deployment by providers of all sizes.

87/ *See* Mobile Future Comments at 7, note 26.

88/ *See Spectrum Frontiers Report and Order* ¶ 82.

89/ *See id.* ¶ 6.

90/ *See, e.g.*, Comments of the Rural Wireless Association, Inc., GN Docket No. 17-258, at 4 (filed Dec. 28, 2017) ("Changing the geographic area licensing scheme at this late date all but ensures that no small providers or new business entrants will successfully utilize the spectrum."); Comments of the Enterprise Wireless Alliance, GN Docket No. 17-258, at 4 (filed Dec. 28, 2017) ("[PEA licensing] would severely limit, perhaps eliminate, any realistic opportunity for successful auction participation by other than the proponents of larger license areas[.]"); Wireless Internet Service Providers Association Comments at 27 ("PALs will be gifted to the few large carriers that can support a business model

First, auctions are not the only means through which entities with more limited needs could seek access to PAL spectrum. By authorizing and promoting secondary market transactions such as partitioning, disaggregation, and leasing, the Commission would further enable targeted deployments by smaller providers and encourage maximum flexibility and deployment in the band. Concerns that licensees will not have sufficient incentives to voluntarily disaggregate or partition a license can remedied by adoption of reasonable performance requirements associated with renewal expectations. In addition, as CTIA notes, "rather than opportunistic GAA operations on unused PAL spectrum, it is likely that PAL licensees will prefer to enter into such partitioning and disaggregation arrangements where market interest exists and to derive some benefit [from] their licensed spectrum."[91/] Arguments that transaction costs are a barrier to secondary market transactions or that "[w]ireless carriers would likely extract substantial economic rents at 3.5 GHz"[92/] are unsupported and refuted by evidence in the record. For example, Verizon notes that it "engages in dozens of spectrum transactions every year, often with small and rural entities."[93/]

While secondary markets for wireless spectrum are already robust – and there is no evidence that secondary market transaction costs are a barrier to entry – commenters have suggested several ways in which the Commission could make secondary market transactions even more accessible and attractive. For instance, Federated Wireless proposes that the Commission extend the pre-certification process already in place for spectrum manager leases of

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predicated on large-area PEAs; and a wide variety of uses, including rural broadband networks, will be confined to sharing GAA channels made more congested by PAL auction foreclosure.").

91/ CTIA Comments at 10.

92/ General Electric Company Comments at 24.

93/ Verizon Comments at 14.

PAL spectrum to long term *de facto* leasing, transfers, and assignments.[94/] T-Mobile agrees that this would allow licenses and others "to enter into, and quickly execute, transactions that both support the parties' individual use cases" and would "ensure that CBRS spectrum is widely and densely used to consumer benefit."[95/] The Commission should also consider Nokia's proposal that licensees be allowed to register specific PAL Protection Areas ("PPAs") within a PAL, which would then permit lessees to coordinate and use the remaining areas within the PAL by claiming new PPAs for the lessees' own use.[96/] In addition, allowing licensees to lease spectrum within their PPAs, permitting lease agreements that specify PAL protection requirements different from those in the Part 96 rules, and providing that lessee use of PAL spectrum counts toward a licensee's satisfaction of any performance obligations adopted would help "maximize [licensee's] ability and incentive to engage in secondary markets transactions."[97/]

Second, while some smaller providers and their representatives argue that PEA-based licensing favors a particular business model,[98/] the current micro-sized service areas are even more biased, as they will depress beneficial wireless carrier investment in the band in favor of far more limited investment from smaller entities.[99/] Similarly, the county-sized service areas

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94/ *See* Federated Wireless Comments at 6-8; *see also* Verizon Comments at 15 (supporting a pre-certification approach to PAL leases).

95/ Federated Wireless Comments at 8.

96/ Nokia Comments at 5.

97/ Federated Wireless Comments at 9-10. Ruckus Networks suggests that the Commission re-visit its earlier determination not to take a position on the formation of spectrum exchanges, as a way to facilitate secondary market transactions. Comments of Ruckus Networks, GN Docket No. 17-258, at 16 (filed Dec. 28, 2017). T-Mobile supports industry-led efforts like spectrum exchanges that can lead to additional secondary market transactions. However, there is no need for Commission endorsement or involvement in the creation of those exchanges.

98/ *See, e.g.*, Wireless Internet Service Providers Association Comments at 34; Rural Wireless Association Comments at 3-4.

99/ *See also* Verizon Comments at 11 ("[T]he prospect of a cluttered, interference-laden 3.5 GHz band will deflate service provider interest in the band and reduce investment in technology.").

promoted by the cable industry[100/] serve their narrow interests – cable franchises are often awarded on a county-wide basis,[101/] but counties are otherwise irrelevant to market economics. And while carriers that wish to serve larger geographic areas can certainly attempt to aggregate them at auction,[102/] there is no guarantee they will be successful, and if they are not, they will be required to overcome the significant spectrum management challenges created by small geographic areas (discussed in more detail below). The Commission should not prejudice providing service to larger areas because it (wrongly) believes smaller license areas will help smaller providers.

Third, there is no reason to believe that smaller providers will be unable to compete at auction if PALs are issued in larger geographic areas. Recent auction history demonstrates that larger license sizes do not preclude smaller providers for bidding on and winning licenses at auction. As highlighted by Mobile Future, numerous smaller businesses won licenses in the Incentive Auction and AWS-3 auction – both of which employed larger license sizes.[103/] The Commission has also traditionally provided meaningful discounts for small businesses in

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100/ *See* Comcast Comments at 4-10; NCTA Comments at 3-6; Comments of Charter Communications, Inc., GN Docket No. 17-258, at 2-3 (filed Dec. 28, 2017).

101/ The Designated Market Areas used for determining cable operators' signal carriage obligations are also composed of counties. *See also* Comments of Frontier Communications Corporation, Windstream Services, LLC, and Consolidated Communications, Inc., GN Docket No. 17-258, at 9-10 (filed Dec. 28, 2017) ("[C]ounty-sized licenses would unfairly favor just one type of competitor. Cable systems often track county lines and many franchises are awarded on the county-level. In contrast, other competitors do not track county lines in this manner – ILEC footprints, for instance, are based off of historical wire centers or central offices, which do not follow county lines (or any other standard geographical unit, including census tracts).").

102/ *See, e.g.*, ATN International Comments at 6-7.

103/ *See* Mobile Future Comments at 8-9; *see also* AT&T Comments at 6-7 (discussing the Incentive Auction).

auctions.[104/] Bidding preferences are the way in which Commission and Congress have decided that small businesses can compete against larger businesses in auctions[105/] – not by creating license areas that favor a particular category of bidder and business case.

PEA-based licensing is already a compromise between larger and smaller license areas and, as the Commission has recognized, would encourage investment by entities of all sizes.[106/] The record contains no evidence of why the compromise license size of PEAs – which was adopted in for the Incentive Auction and in the millimeter wave bands – would not also strike an appropriate balance here. The Commission should therefore enable the greatest amount of growth and deployment in the 3.5 GHz band by providing for larger service areas and making more secondary market mechanisms available.

D. Smaller License Areas Are Not Necessary to Support Campus-Sized Applications

Concern that larger license sizes will reduce access to interference-protected spectrum for users who have campus-sized needs[107/] are misplaced. *First*, current micro-sized census tract licenses are themselves a bad fit for campus-sized applications. Census tract licenses are already significantly larger than a single business campus, hotel, or factory, and the Commission previously considered and correctly rejected license areas even smaller than census tracts for granular and demand-focused assignments, noting that even smaller license areas would

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104/ For instance, in the Incentive Auction, the Commission provided a rural service provider bidding credit of 15%, a very small business bidding credit of 25%, and a small business credit of 15%. *See Updating Part 1 Competitive Bidding Rules et al.*, Report and Order, 30 FCC Rcd 7493 (2015).

105/ *See, e.g.*, 47 U.S.C. § 309(j) (granting the Commission authority or consider the use of bidding preferences).

106/ *See Spectrum Frontiers Report and Order* ¶ 82 (stating that licensing on a "PEA basis strikes the appropriate balance between facilitating access to spectrum by both large and small providers and simplifying frequency coordination while incentivizing investment in, and rapid deployment of, new technologies.").

107/ *See, e.g.*, Motorola Solutions Comments at 2-4.

"significantly increase the complexity and data management requirements . . . with diminishing and no obvious improvement in spectral efficiency."[108/]

Second, the demands of campus-sized applications, which can serve valuable purposes, can be satisfied in ways that provide interference protection besides micro-sized license areas. For instance, and as discussed above, entities with limited coverage requirements could enter into transactions tailored to the area or amount of spectrum they desire through partitioning, disaggregation, or leasing. Users with campus-sized needs could also enter into commercial agreements with PAL licensees in which the licensees manage the spectrum. Campus-sized requirements may also be satisfied with GAA spectrum – even those with requirements for reliable access to spectrum. As noted above, industry-led work continues on interference avoidance techniques for unlicensed operations at 3.5 GHz[109/] As SAS management techniques evolve – potentially aided by similar indoor applications of other spectrum users – access to GAA spectrum will become more predictable. Therefore, smaller license areas are not necessary to encourage use of the band by entities with more limited needs.

E. PEA-Sized Licenses Will Not Leave Rural Areas Unserved

Some commenters expressed concerns that PEA-based licensing will leave rural areas unserved.[110/] These concerns are unfounded. *First*, T-Mobile rejects the notion that larger wireless providers do not or will not serve rural areas.[111/] T-Mobile, for example, continues to invest in and expand its network infrastructure, and its LTE network now covers 322 million

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108/ *3.5 GHz Report and Order* ¶ 99 (quoting Spectrum Bridge FNPRM Comments, Appendix, at 1).

109/ Google Comments at 23-24.

110/ OTI and PK Comments at 22; Frontier Communications Comments at 7; NRTC and NRECA Comments at 5-6; Rural Wireless Association Comments at 4.

111/ *See, e.g.*, NRTC and NRECA Comments at 6 ("Offering licenses by PEA risks a result in which large rural areas are licensed, but not served, by carriers looking to provide service in urban cores.").

people, up from 315 last year, bringing coverage and competition to entirely new places.[112/] However, to the extent that carriers do not build out in some areas using 3.5 GHz spectrum, the CBRS's three-tier structure is designed to prevent the exact result claimed by these commenters. Specifically, any spectrum not being put to use by a PAL licensee will be available for GAA use – the spectrum will not be left to lie fallow.

Second, as discussed above, if rural providers seek the stability that licensed spectrum provides, there are many avenues through which they could acquire it – for instance, by taking advantage of the secondary market or by bidding at auction at discounted rates.

F. Smaller License Areas Will Result in Inefficient Spectrum Use

Spectrum is a scarce resource for which demand is continually growing. Accordingly, one of the Commission's goals in this proceeding has been to "add much-needed capacity to meet the ever-increasing demands of wireless innovation."[113/] Smaller license areas, however, will *reduce* users' ability to deploy CBSDs, resulting in inefficient spectrum use directly contrary to the Commission's goals.

In order to protect a CBSD deployed by a PAL licensee, Section 96.41 of the Commission's rules require that the SAS refrain from authorizing other Priority Access or GAA CBSDs on the same channel in geographic areas and at maximum power levels that will cause aggregate interference in excess of -80 dBm/10 MHz channel within the licensee's PPA.[114/] If smaller license areas are used, these protection requirements limit licensees' ability to fully utilize their assigned spectrum throughout their geographic service areas, reducing the

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112/ *T-Mobile #1 in Customer Satisfaction Throughout 2017*, T-MOBILE (Jan. 3, 2018), https://newsroom.t-mobile.com/news-and-blogs/number-1-customer-satisfaction-2017.htm.

113/ *3.5 GHz Report and Order* ¶ 1.

114/ The PPA is the PAL licensee's protection contour, as reported by the licensee or calculated by the SAS. *See* 47 C.F.R. § 96.3.

effectiveness of the band. This is because, with small license areas, there is a much higher likelihood that when a licensee seeks to deploy a CBSD, there will be a nearby Priority Access CBSD that requires protection, forcing the licensee to reduce power, move its CBSD away from its PAL border in order to use a higher power, or take other steps to protect the transmitter deployed in the adjacent geographic area.[115/] This will limit the number of places where transmitters can be located and curb licensees' ability to fully deploy services using their licensed spectrum in their geographic service areas. In contrast, with larger geographic license areas, it is less likely that there will be another licensee's CBSD nearby, providing additional flexibility to site CBSDs near the border with full power. Table 1, below shows the dramatic difference between the linear mileage of boundaries between PEAs and other geographic areas. While PEAs would create approximately 222,000 miles of boundaries, census tracts would create nearly 1.5 million linear miles of boundaries – more than 6.5 times the number of linear miles that PEAs would create.

Table 1. Linear Mileage Border Comparison

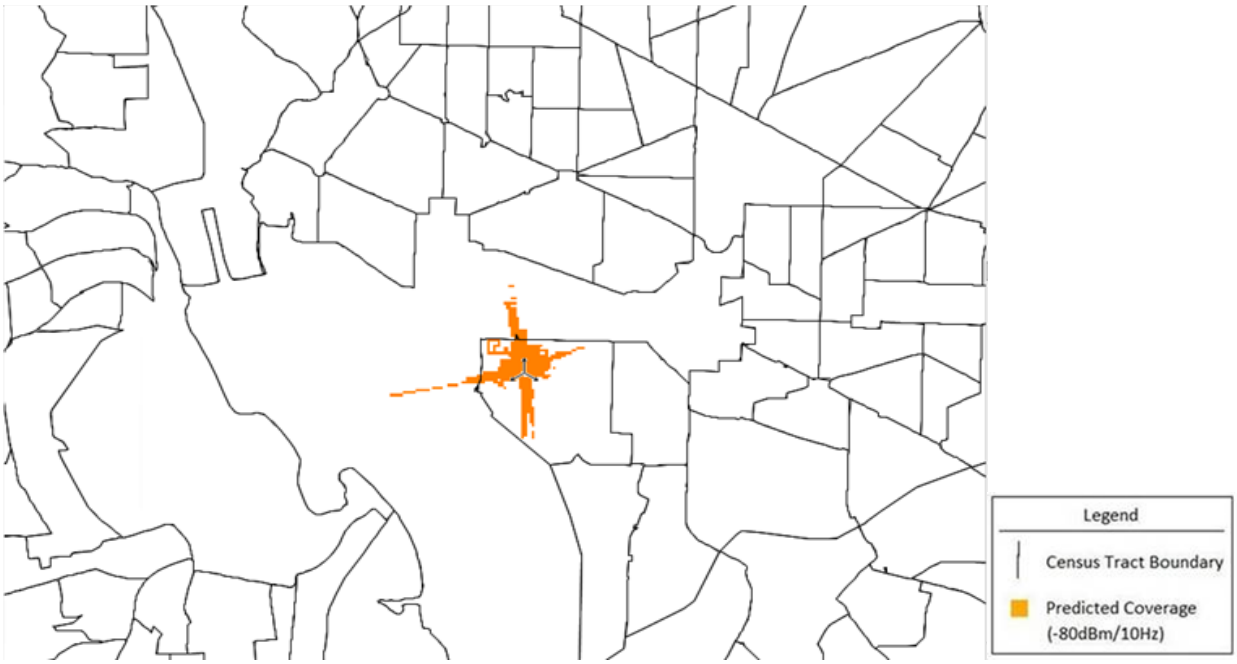
Political Boundary	Border Length (Miles)
Census Tract	1,465,038.27
County	536,857.37
PEA	221,955.66

As an example of the results this would produce, the map below shows the coverage of a CBSD located at the Commission's Washington, D.C. headquarters with a received signal strength of -80 dBm, the maximum permitted under the rules. Because the signal extends beyond the census tract border – even though the Commission's headquarters are not near a census tract

115/ *See also* AT&T Comments at 5 ("[S]maller Census Tract parcels greatly complicate[] the ability of PAL licensees to effectively manage interference borders."); CTIA Comments at 8-9.

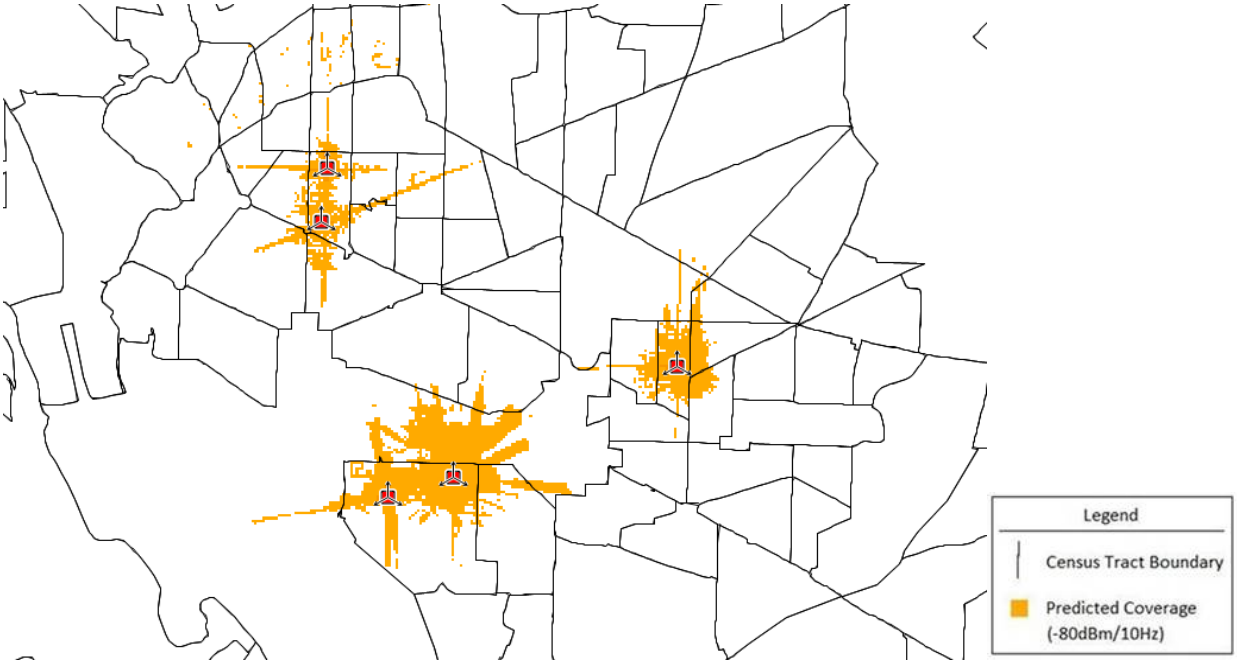
border – an SAS would be required to reduce the permitted power of the CBSD if a co-channel PAL user is operating near the census tract border. And, if the CBSD were operated closer to the border of the census tract in which the Commission's headquarters are located, its power would be required to be reduced even further.

Fig. 1. Predicted Coverage of a Single CBSD at the Commission's D.C. Headquarters



And because an SAS is required to take into effect *aggregate* interference, the limitations outlined above will become worse when additional CBSDs are added. Figure 2 shows the impact of two CBSDs on the potential use of spectrum in an adjacent census tract. Because of the aggregate effect of multiple transmitters, there is an even greater signal outside the census tract, meaning even less flexibility and more requirement to reduce signal strength.

Fig. 2. Predicted Coverage of Multiple CBSDs at the Commission's D.C. Headquarters



In addition, with so many linear square miles of shared boundaries, extension agreements, common for many wireless services, are not feasible. Larger license areas, in contrast, allow licensees to coordinate with their neighbors more easily. This will be particularly significant in the 3.5 GHz band, where license holders may use different technologies and/or different frame structures in the case of TDD-LTE, making coordination more complex than it is in bands where users employ similar LTE technology.

Smaller license areas will also make it more challenging for SASs to manage the spectrum, in part because channels will be re-used less frequently. And with less channel re-use, fewer channels will be vacant for potential GAA operations. Smaller license sizes will therefore negatively affect both GAA and PAL licensee spectrum use. These problems will be even worse if license assignments are dynamic and licensees are not able to reach cross-border agreements. Larger license sizes and static assignment, in contrast, would create greater frequency access for GAA users as well.

The problems above would not be resolved by issuing county-sized licenses, as there are over 3,200 counties and county equivalents in the U.S.[116/] Moreover, each of the issues above will be exacerbated in urban areas. As the chart below and maps included in the Appendix to these comments show, PEAs in urban areas contain many more counties or census tracts than do PEAs in a rural area. The top urban PEAs in terms of population generally contain over a dozen counties and thousands of census tracts. In contrast, the most rural PEAs by population all contain fewer than ten counties or census tracts.

Table. 2. Number of Counties and Census Tracts Contained in the Most Populated and Least Populated PEAs[117/]

PEA	PEA Number	Number of Counties in PEA	Number of Census Tracts in PEA
New York, NY	1	42	6,023
Los Angeles, CA	2	8	4,212
Chicago, IL	3	12	2,199
San Francisco, CA	4	13	1,960
Baltimore, MD – Washington, DC	5	26	1,909
Salmon, ID	407	3	5
Ballinger, TX	408	3	7
Haskell, TX	409	5	7
Valentine, NE	410	3	5
Van Horn, TX	411	2	2

Therefore, if PALs are issued using license sizes smaller than PEAs, spectrum management requirements will render the spectrum nearly unusable in urban areas where the licenses are held by different entities. The Commission should not so hobble use of the 3.5 GHz band by issuing

116/ *How many counties are there in the United States?*, U.S. GEOLOGICAL SURVEY, https://www.usgs.gov/faqs/how-many-counties-are-there-united-states (last accessed Jan. 29, 2018) (includes D.C. and the territories).

117/ Continental United States only.

licenses in smaller sizes. Based on the foregoing, it is clear that the vast majority of major markets should remain licensed as PEAs

G. Census Tract Licensing Is Particularly Problematic

Census tracts, in particular, present complications beyond their sheer number (over 74,000)[118/] and the protection and deployment flexibility issues outlined above. Census tracts are not necessarily invariable geographic units. They can change over time, updated by local participants and/or the Census Bureau before each census, usually to account for shifts in population.[119/] As a result, in any re-auction of PALs, new license areas may not conform to original license areas.

V. CONCLUSIONS

T-Mobile appreciates the Commission's efforts in this proceeding to maximize investment in the 3.5 GHz band through modest, necessary rule changes. The record supports the Commission taking the following actions:

- Authorizing PALs on a standard, ten-year license term with a renewal expectancy.
- Making all PAL spectrum available for auction and permitting bidding on specific channels.
- Imposing a 30 megahertz spectrum aggregation limit.
- Allowing partitioning and disaggregation.
- Preventing disclosure of CBSD registration information.
- Relaxing OOBE limits.
- Licensing PALs on a PEA basis.

118/ *See 2010 Census Tallies of Census Tracts, Block Groups & Blocks*, UNITED STATES CENSUS BUREAU, https://www.census.gov/geo/maps-data/data/tallies/tractblock.html (last visited Jan. 29, 2018).

119/ *See Geographic Terms and Concepts - Census Tract*, UNITED STATES CENSUS BUREAU, https://www.census.gov/geo/reference/gtc/gtc_ct.html (last visited Jan. 29, 2018).

Respectfully submitted,

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January 29, 2018

APPENDIX

Fig. 1. Map Showing PEA Boundaries

Fig. 2. Map Showing County Boundaries

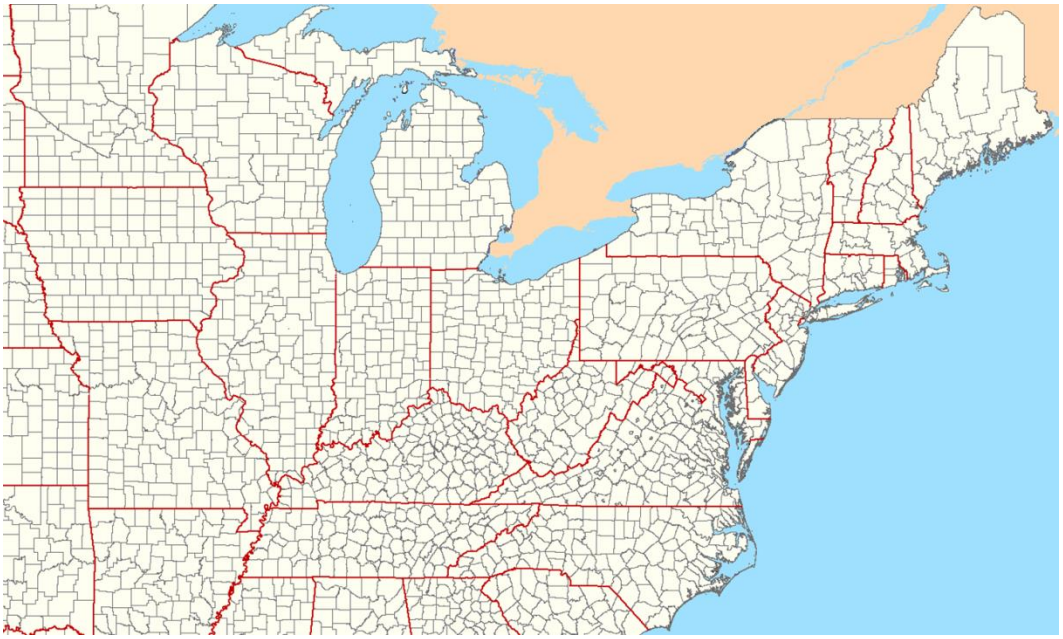

Fig. 3. Map Showing Census Tract Boundaries